



Transport
Roads & Maritime
Services

Test method T435

Apparent particle density of fine material

OCTOBER 2012



Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	May 1999
		Date on Test Method Revised to Agree with Date on Revision Summary	D.Dash	Feb 2001
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T435 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T435

Apparent particle density of fine material

1. Scope

This standard sets out the method for the determination of apparent particle density of fine materials, such as filler for asphalt.

The apparent particle density is required to determine the voids in dry compacted fine materials by the procedure described in Test Method T436. The method conforms to that described in Australian Standard 1141.7.

2. General

Term	Definition
The apparent particle density	(a) Is the ratio of the mass of solids in air to the volume of solids and impermeable voids, at 25°C, expressed in tonnes per cubic metre

3. Apparatus

- A balance of at least 200 g capacity, readable and accurate to 0.001 g within the operating range.
- Water bath, constant temperature, set to $25 \pm 0.1^\circ\text{C}$.
- A density bottle, of 50 mL or 100 mL capacity.
- Small funnel.
- A thermostatically controlled oven with good air circulation, capable of maintaining a temperature with range of 105°C to 110°C .
- A vacuum desiccator, 200 mm to 250 mm diameter, containing anhydrous silica gel and a pump capable of reducing the pressure below 5 kPa.

4. Dilatometric Liquid

- Redistilled kerosene, purified xylene or purified aviation fuel, kept over a dehydrating and deacidifying agent, e.g. portland cement;
or
- Distilled water, when the filler is known not to react with water.

5. Test Portion

The test portion shall consist of up to 200 g of the material.

6. Calibration of Density Bottle

- Remove any static charge from the clean, dry density bottle by wiping it with a clean, lint-free cloth which has been slightly dampened with water.
- Weigh the density bottle and stopper to the nearest 0.001 g and record the mass (m_1).
- Fill the bottle completely with freshly boiled and cooled distilled water.
- Immerse the bottle in the water bath set to $25 \pm 0.1^\circ\text{C}$ to within approximately 5 mm from the top.
- After 30 min, insert the stopper carefully so that no bubbles are trapped in the neck of the bottle and the excess water is expelled through the capillary in the stopper.
- After a further 10 min, brush the top of the stopper with a slip of filter paper, holding the paper at an angle to ensure a flat surface is passed over the capillary opening. Do not hold the bottle by hand during this process.

- (g) Without touching by hand, remove the bottle from the water bath, dry carefully, remove any static charge and weigh immediately. Alternatively, provided that the room temperature is below 25°C, the bottle may be allowed to reach equilibrium with room temperature before weighing. Record the mass of bottle plus contents (m_2)
- (h) Calculate the mass of water in the bottle (M_{wb}) by subtracting m_1 from m_2 .
- (i) Calculate the volume, in millilitres, of a bottle at 25°C (V_w) as follows:-

$$V_w = \frac{M_{wb}}{0.997}$$

Where M_{wb} = mass of distilled water in the bottle at 25°C, in gram

0.997 = density of distilled water at 25°C in kilograms per litre.

7. Procedure

- (a) Using the procedure prescribed in *Calibration of Density Bottle*, weight the bottle and stopper when filled with the dilatometric liquid and record the mass (m_3).
- (b) Dry the test portion of material for 4 hours in the oven at a temperature of 105°C to 110°C and cool in the desiccator to room temperature.
- (c) Clean and dry the bottle and add the material through the funnel until the bottle is approximately one-third full. Weigh the bottle plus contents and stopper and record the mass (m_4).
- (d) Add sufficient dilatometric liquid to cover the material and half fill the bottle. Release entrapped air by giving the bottle and contents a few light taps on the bench and then subjecting the bottle and contents to reduced pressure (approximately 5 kPa) in a vacuum desiccator for at least 5 min. Repeat this procedure for releasing air until no further bubbles appear.
- (e) Add further dilatometric liquid to fill the bottle completely and immerse the bottle in water bath set at 25 ± 0.1°C to within approximately 5 mm from the top.
- (f) After 30 min, brush the top of the stopper carefully so that no bubbles are trapped in the neck of the bottle and the excess liquid is expelled through the capillary in the stopper.
- (g) After a further 30 min, brush the top of the stopper with a slip of filter paper, holding the paper at an angle to ensure a flat surface is passed over the capillary opening. Do not hold the bottle by hand during this process.
- (h) Without touching by hand, remove the bottle from the bath, dry carefully, remove any static charge and weigh immediately. Alternatively, provided that the room temperature is below 25°C, the bottle may be allowed to reach equilibrium with room temperature before weighing, record the mass (m_5).
- (i) Make two separate determinations of the apparent particle density of the material and record both results. If these results differ by more than 0.020, discard and make two fresh determinations.

8. Calculations

Calculate the apparent density using the following formula:-

$$D = \frac{m_3 - m_1}{V_w}$$

$$p = \frac{m_4 - m_1}{v_w - \frac{1}{D}(m_5 - m_4)}$$

Where D = density of the dilatometric liquid at 25°C, in tonnes per cubic metre.

p = apparent particle density of the material, in tonnes per cubic metre.

m_1 = mass of stopper and density bottle, empty, in grams.

m_3 = mass of stopper, density bottle and dilatometric liquid in grams.

m_4 = mass of stopper, density bottle and filler, in grams.

m_5 = mass of stopper, density bottle, material and dilatometric liquid, in grams.

V_w = volume of bottle at 25°C as determined in *Calibration of Density Bottle*, in millimetres.

9. Reporting of results

Report the mean of the two results to three decimal places, as the apparent particle density of the fine material.

10. Repeatability

Results obtained by one operator using the same equipment in one repeat test on different test portions drawn from the same sample should not vary by more than 0.5 percent of the mean value.